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seemed to justify further experiments, and the steamer "Fuso-kan" was docked, and part of her bottom sheathed with the lacquer. Immediately after an examination of her hull a year later, the Japanese Admiralty ordered a cruiser to be treated by this process, and the European nations, not to be left behind in the game, followed suit. The Russian Government had the warships "Dmitri Donskoi" and "Admiral Nachimoff" lacquered in 1890, and the United States naval authorities took cognizance of the new invention in 1891. In that year the Japanese lacquering company sent over steel plates treated with the new preservative, which were submerged at the Norfolk Navy Yard and taken up three months later. Nothing, however, was done by our Government to adopt this method of preserving our warships from fouling, and for various reasons the Japanese process of lacquering warships' bottoms has not made much advance in the European navies.

All of the governments have fallen back upon copper, or compositions in which copper is the predominant metal, for sheathing their warships. Electroplating the bottoms of ships with copper has recently been experimented extensively with, and this does away with many of the old objections to copper sheathing. Where the copper plates were nailed on the ships, "pitting" nearly always started at the nail holes. If the salt water was allowed to enter here even in the smallest quantity, corrosion would begin at once, and in a short time do great damage to the steel hull. In electroplating, however, the copper sheathing is put on in one unbroken mass, and there is no danger from "pitting." When the whole surface has been electroplated with copper a smooth and unbroken surface is presented, and it fits so closely that the sheathing cannot be removed without sometimes chipping off the iron. Moreover, this sheathing is merely a light film of copper, and its weight is so small that it averages only 2.85 pounds to the square foot.

While copper sheathing is not a perfect anti-fouling material, it is so satisfactory that ships with their bottoms so treated can often remain in warm seas for two years without being docked. Ordinarily an unsheathed vessel could not remain in such waters more than six months without having its bottom so covered with barnacles that its speed would be seriously reduced. Copper sheathing not only gives a smooth surface which offers no friction to the water, but the barnacles are killed by the poison from the copper. The small marine animals attach themselves to this copper surface and absorb the poison, which kills them and makes them drop off. This poison is produced by the gradual dissolution of the copper by coming in contact with the salt water. The chemical process in time ruins the copper bottom, and if it does not dissolve fast enough the marine animals secure a good foothold on it. All of the anti-fouling paints and compositions imitate the action of copper. Most of them are composed of copper, mercury, zinc, or arsenic. Next to copper, zinc has been used more commonly in European navies than any other metal, but this does not act as well in salt water as copper, and its use is gradually dying out.

G. E. WALSH.

LABOR-SAVING DEVICES IN LITERARY WORK.

IN approaching the question as to what has been done by literary men to lighten the mechanical side of their labors, we are struck with their lack of progress. The reasons for this deficiency are two-fold; the literary man is not a mechanic, and he believes this side of his work to be beneath his consideration. But in looking at the writer as a machine producing marketable material, which is after all the most important aspect of his profession, the importance of this question becomes at once far greater.

I use the term "literary man" in its broadest sense, to include everyone who uses his brain for composition. Personally I was never more impressed with this lack of progress than in reading a recent magazine account of the reporting of the inauguration of a president of the United States. The material, collected in a rapid, skilful manner, was written out by the reporter, word by word; twelve hours being required for the task. The entire nervous energy of the reporter was exhausted by the work. There should have been some method devised by which this work could have been done in at least one-third the time and with one hundredth expenditure of energy. This importance grows doubly significant in the light of the recent views of physiologists that life is simply an impetus given to our organism at its birth, which can be used up speedily or spread over a number of years.

There are many serious objections to the use of the pen in composing. There is a great disparity between the speed of thought and that of the pen; the thought is frequently lost before it can be recorded. This chase after thought accounts for the bad penmanship of the average literary worker. Again, the manual labor involved soon tires the body and fatigues the fancy, especially as the silly mediæval habit of crippling the left hand is still in vogue among our writing masters.

The two great methods of shortening the labors of composition are at present stenography and the use of the phonograph. Shorthand writing has many disadvantages, for if one does the work himself he is compelled to write it out afterwards or dictate it to some one else, as each writer's system is generally intelligible only to himself. This does not shorten time or labor. If one has the work done, it simply transfers the expenditure of time and labor to some one else, and does not shorten the time between composition and possible publication. Again, the average stenographer is of little service in steady literary work; being generally poorly educated and tiring easily in brain and hand, he is more or less of a broken reed. A very rapid long-hand writer frequently does far better; a composer can generally slow his pace sufficiently to dictate his work in this way.

The use of the phonograph is the alternative for more rapid composition. The writer has refrained from expressing an opinion until he has used it for ten months. His experience has taught him that the phonograph requires a training similar to that required in learning the use of the typewriter; for example, after the "recording cylinder" is put in place, there appears at once in the dictater a sense of hurry, more intense than that experienced at best in dictating to a stenographer. It takes time to learn to keep one's wits from being distracted by gazing at the revolving wheels. Then, again, he must learn the management of a delicate machine that must be kept in perfect order; he must learn to articulate properly and to stop his machine when not actually dictating.

The most serious objection to the phonograph, as to the stenographer, is that it requires some one to take off the dictation. If the writer does this himself he saves no time; besides, the labor of "reading off the cylinder" is very brain fatiguing. There is, too, the same likelihood of mistakes, for, despite all care, words will sound indistinct and misleading.

In looking into the future, we find ourselves staring at a blank wall; for, with the exception of the phonograph and the typewriter, no recent advance has been made in lessening literary work. The ideal method of composition would be the use of some machine into which the operator could talk and have his spoken word reproduced at once on paper as the written word; but, unfortunately, like printing photographs in colors, each succeeding advance and discovery in the world of invention seems to make this hope more and more improbable. The insurmountable difficulty lies in the fact that there is no connection between the sound of a word and its appearance on paper. We will never reach this ideal state. It has its disadvantages, too, for probably it would turn the whole world into a producer of literature in its broadest sense, for composition would be so easy. This might drive the present writers to the wall by mere force of numbers; so its improbability may be their preservation.

This leaves us with practically only the phonograph as our hope for future development. The simplest method developing along the line on which the phonograph has started, would be to retain the articles on the cylinder all the way from writer to editor and compositor: the writer to send his articles to the editor on his cylinders, the editor to judge of their adaptability to his use by "reading them off" on his own machine; on their acceptance, the compositor to set them up in type directly from the cylinders, so that the first time that they would be seen in legible form would be in "galley proof." In this way the trouble of reproducing the articles in written form would be avoided. Of course, this method would require the education of literary men who could judge of their work without the help of the eye; of editors who could judge of the merit of articles and their length by the ear alone, and of compositors who would be similarly placed. But this objection is one that can be made to all advance in any line. Undoubtedly educating all three divisions of workers to do work in this way is perfectly possible. But it seems as though nature intended to every substantial advance to attach a corresponding defect. The wonderful machinery by which the manufacturers of to-day produce such great amounts of furniture would astound the comprehension of our grandfathers; but the furniture of our grandfathers will still exist as heirlooms long after our modern furniture has become unglued and unsewed. So it is with writing rapidly produced; it is exactly the difference between machine and hand-made articles. We could not imagine Milton dictating his "Paradise Lost" on a phonograph. His work was done only by many years of hardest thought. The same amount of material could be rattled off on a phonograph in a week's time, but it would last in the public mind but a week, while Milton wrote for eternity.

Undoubtedly, as we progress more advance will be made in preparing literary work for use, but these devices can be used only where quantity is wanted and quality not demanded. That will be its limitations. For writing letters and describing inaugurations the phonograph, or some better machine, will come into general use in future years; but for the higher form of literature, undoubtedly the quill which was used by Shakespeare and Addison did the best work, and the writer who would emulate them in the smallest degree must use their methods. The mechanical work of Elizabeth's and Anne's time seems to us as nothing, but we have yet to excel the work of their literary men.

J. HOWE ADAMS.